
Wnt signaling regulates homeostasis of the periodontal ligament.

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Public Summary:

The periodontal ligament is a Wnt-dependent tissue. Cells in the periodontal complex are Wnt responsive, and eliminating an essential component of the Wnt signaling network leads to a pathological widening of the periodontal ligament space. Osteogenic stimuli are reduced, and a disorganized fibrillary matrix results from the depletion of Wnt signaling. Collectively, these data underscore the importance of Wnt signaling in homeostasis of the periodontal ligament.

Scientific Abstract:

BACKGROUND AND OBJECTIVE: In health, the periodontal ligament maintains a constant width throughout an organism's lifetime. The molecular signals responsible for maintaining homeostatic control over the periodontal ligament are unknown. The purpose of this study was to investigate the role of Wnt signaling in this process by removing an essential chaperone protein, Wntless (Wls), from odontoblasts and cementoblasts, and observing the effects of Wnt depletion on cells of the periodontal complex. **MATERIAL AND METHODS:** The Wnt responsive status of the periodontal complex was assessed using two strains of Wnt reporter mice: Axin2LacZ/+ and Lgr5LacZ/+ . The function of this endogenous Wnt signal was evaluated by conditionally eliminating the Wntless (Wls) gene using an osteocalcin Cre driver. The resulting OCN-Cre;Wls fl/fl mice were examined using micro-computed tomography and histology, immunohistochemical analyses for osteopontin, Runx2 and fibromodulin, in-situ hybridization for osterix and alkaline phosphatase activity. **RESULTS:** The adult periodontal ligament is Wnt responsive. Elimination of Wnt signaling in the periodontal complex of OCN-Cre;Wlsfl/fl mice resulted in a wider periodontal ligament space. This pathologically increased periodontal width is caused by a reduction in the expression of osteogenic genes and proteins, which results in thinner alveolar bone. A concomitant increase in fibrous tissue occupying the periodontal space was observed, along with a disruption in the orientation of the periodontal ligament. **CONCLUSION:** The periodontal ligament is a Wnt-dependent tissue. Cells in the periodontal complex are Wnt responsive, and eliminating an essential component of the Wnt signaling network leads to a pathological widening of the periodontal ligament space. Osteogenic stimuli are reduced, and a disorganized fibrillary matrix results from the depletion of Wnt signaling. Collectively, these data underscore the importance of Wnt signaling in homeostasis of the periodontal ligament.

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